IN THE SPECIFICATION

Please amend the specification as follows:

1) On page 1, please add the following above the Technical Field sub-section:

"Cross-Reference To Related Applications:

This application claims the benefit of a previously-filed provisional patent application Serial No. 60/170,285 filed on December 10, 1999."

2) On pages 3-4, please amend the following paragraph as shown:

"The task of building a geometric model begins by establishing a set of entities that are of interest in the environment. An entity represents an object which exists in the physical world (e.g., a person, I/O device, or sensor). In the geometric model, an entity is represented by a coordinate frame (or just "frame" for short) and an extent. The frame of an entity has a pre-selected origin somewhere on or within the object. Coordinate axes extend from this origin. In a preferred embodiment of the model, only the orthogonal x and y axes are used and represent the axes that could be "seen" looking down onto the environment. Entity identification information is provided to the geometric model program from external programs. When an entity is first identified, the geometric model program assigns an entity identifier (ID) that uniquely identifies the entity. This information is provided back to the outside program which introduced the entity, and possibly to some other repository of identification information. The entity ID is used by outside programs when updating information about an entity or when making a query about the physical relationships between entities. Entities may be created or deleted ~~and~~ at any time during the period which the model exists."

3) On page 10, please amend the following paragraph as shown:

"The primary purpose of creating and maintaining the geometric model of the ubiquitous computing environment is to respond to queries about the geometric relationships between entities. While a query could be as simple as what extent is associated with a particular entity, typically the requested information will be directed at the relationships between the various entities and/or their extents. There are two fundamental types of queries about these relationships that the geometric model program will be called upon to answer. The first type is a query concerning the relative relationship between two entities. There may be a single measurement already existing between the frames of the entities in question. If so, the answer to the query is straightforward. However, suppose there is no direct measurement between the ~~between~~ entities involved in the query. If at least one path of measurements exists between two entity frames, then a single geometric relationship can be derived between them. However, in such a case the geometric relationship must be derived from the multiple measurements making up the path. The first part of this process is to find a measurement path between the two entity frames in question. One way of doing this is to find a path having the fewest number of measurements between the query entities. This can be accomplished using a breadth-first search procedure. It is noted that if two paths have the same number of measurements (i.e., a tie), either could be chosen arbitrarily, or some selection criteria such as the collective uncertainty of the path could be employed to make the choice. The next phase of the response to the first type of query involving the geometric relationship between two entities is to compute a single measurement describing the relationship and output it to the querying program.

4) On pages 22, please amend the following paragraph as shown:

"An example of the foregoing measurement scheme is illustrated in Fig. 4. The location of an entity (hereinafter referred to as the destination entity as the

measurement ends at the entity), whose frame 402 is shown in the upper right hand corner, in relation to an originating entity (so called as the measurement originates from that entity), whose frame 400 is shown in the lower left hand corner, could be defined by a set of x,y coordinates 404, 406 as viewed from the coordinate frame 400 associated with the originating entity. Specifically, as shown in Fig. 4, the measurement between the frames 400 and 402 of the two entities would include a Δx coordinate 408 associated with the distance between the origins of the two frames along the x-axis 404 of the originating entity's frame 400, and a Δy coordinate 410 associated with the distance between the origins of the two frames along the y-axis 406 of the originating entity's frame 400. The measurement between the frames 400 and 402 of the two entities would also include a $\Delta\theta$ coordinate 412 associated with the degree of rotation of the destination entity's frame 402 in relation to the originating entity's frame 400. This rotational component is a measure of the relative rotation of the destination entity's frame 402 relative to the originating entity's frame 400 about the axis defined by the positive cross product of the x and y axes 404, 406, assuming a right-handed coordinate system. The rotational component can be quite useful for entities such as a display screen or a person as it can be used to determine which way the entity is facing. For example, if a display screen ~~where~~ is directed away from where a person is facing, the person would not be able to see the screen. Thus just knowing the relative positions of the screen and the person would not be enough to determine if the person could see the screen. Furthermore, there is no *a priori* reason to expect that all entities have coordinate frames with their X and Y axes aligned. Thus, a rotational component is needed."

5) On page 24, please amend the following paragraph as shown:

"Measurements in the geometric model preferably reflect the spatial uncertainty associated with the method used to obtain them. For example, a measurement taken directly by a user might be considered more certain ~~that~~ than the same measurement derived from images of the scene. One way of introducing an

uncertainty estimate into the measurements is to employ a Gaussian uncertainty model where rather than a measurement being a particular value, it is provided to the geometric model program as a mean estimate for each coordinate and a covariance matrix for each that is indicative of the uncertainty of the coordinate mean [1]. The advantage of characterizing the measurements in the foregoing way is that it can be used to enhance certain optional procedures performed within the geometric model program that are designed to test the accuracy and possibly even revise the measurements provided to the program."

6) On pages 27, please amend the following paragraph as shown:

"It was mentioned previously that an entity is represented in the geometric model as a coordinate frame and an extent. The extent of an entity will now be described. Real world entities will have some physical size. In addition, ~~an~~ a physical object could have some service region, such as a field of view associated with a camera or display device. It is advantageous to augment the geometric model with these region descriptions, which are called extents. Thus, an inputting program would include in its description of an entity any extents associated with the entity. The geometric program would preferably treat each entity-extent combination which is related to the same physical item as separate entities with a measurement of zero between them. Thus, each entity has only one extent, but multiple entities may represent the same physical device in the model. By default in the preferred embodiment, if no extent is explicitly specified for an entity, a point extent is assumed. This point extent can be defined as being located at the origin of the entity's frame, or at a location having some prescribed geometric relationship to the origin of the entity's frame. It is noted that the description of the area in the environment associated with an extent is expressed in terms of the coordinate frame of the corresponding entity. The significance of this entity-extent approach will become apparent in the upcoming discussion of querying the geometric model program about geometric relationship in the environment. The extent of an entity can be expressed as

having any planar geometric shape. However, in tested embodiments of the geometric model program the area associated with an extent was expressed as a polygon, (including degenerate cases such as a point when no extent is specified or a line segment such as in the case of a flat display screen which appears as a line from above)."

7) On pages 36, please amend the following paragraph as shown:

"Another interesting aspect of the last example is that even if there are ~~no~~ overlapping extents, this does not mean that the person is actually facing toward the display screen. The purpose for the query may be that the querying program wants to display something intended for the person to see. This is where the aforementioned rotational coordinates used to indicate the "heading" of an entity could come into play. For instance, if the rotation component associated with the person indicates that the display screen would be in his or her field of view, then this would be reported. If not, then it could be reported to the querying program that the person could not see the display screen. The same procedure could be performed in the context of the display screen to ensure that it is oriented such that the person can see it."